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# The Impact of Learning Environments on Student Engagement

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# THE IMPACT OF LEARNING ENVIRONMENTS ON STUDENT ENGAGEMENT



VLK | ARCHITECTS



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September 27, 2017

Dear Reader,

Over our 33 years of providing architectural services to Texas public school districts, we have made hundreds of presentations to school boards, and attended thousands of design meetings with administrators and campus staffs resulting in the design and construction of millions of square feet of learning environments that we believe contribute to student engagement in the learning process.

But what we believed, we could not prove. Until now.

We needed to know if the schools we design benefitted learning and how. We tell our clients that the learning environments we design with them help their students learn and teachers teach, but do they? We had anecdotal information and opinions that supported our beliefs gained through post occupancy surveys and interviews, but nothing gathered in a research-based format as scholarly evidence that would withstand scrutiny.

With the distinctive occurrence of two design assignments, an opportunity presented itself to study our impact. In 2016, VLK Architects commissioned the University of Texas at Tyler to conduct a study resulting in original research titled, "The Impact of Learning Environments on Student Engagement". Uniquely, VLK Architects was awarded the design assignment for two replacement elementary schools that, while located in separate districts, would be rebuilt on their same sites; thereby, serving the same student population, community demographics, teaching and administrative staffs.

The following manuscript explores the impact of architectural design on student engagement. It is our hope that this research will add to the already present literature that exists regarding architectural design in educational facilities and will spawn new research and further advance architectural practice in the design of educational facilities.

Sincerely,  
**VLK Architects, Inc.**

Kenneth R. Hutchens  
Principal of Creative

# **The Impact of Learning Environments on Student Engagement**

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Architects design schools every day, but the impact that their designs have on student learning is at times unknown to those that design the schools. Educational research has shown that a positive school culture impacts student achievement; among the factors that impact the school culture is having a safe school (K12 Insight, 2017). Pride, student behavior, and overall safety each impact a school's culture. A sense of pride and overall school safety can be influenced by the conditions of the building where children go to school.

The purpose of this manuscript is to explore the impact architectural design had on two replacement schools by addressing the research question: What impact does innovative replacement school design have on student engagement in the learning process? Intentionally, the larger study from which the findings reported in this manuscript were drawn was designed to address the gap in literature that exists regarding architectural design factors that have an effect on learning, particularly the literature regarding replacement schools and the impact the design of new schools had on existing school communities – the students and the teachers who were previously at an old building and all moved to the new school building. Research can also be found regarding the cost effectiveness of building replacement schools (Lewis et al., 2000) rather than remodeling an old building. However, there is no available literature focused on the impact replacement schools have on student engagement and achievement.

## **Relevant Literature**

This literature review<sup>1</sup> will cover five identified objectives as identified by VLK Architects<sup>2</sup>. The five identified objectives are: replacement schools, innovative/unique spaces, teachers' perceptions of student engagement, school climate/school culture changes, and sound in learning environments. Due to the similarities between some of these categories, the first (replacement schools) and fourth (school climate/school culture) were combined to accommodate the breadth of the literature. Due to the nature of student engagement and the goals of this literature review there are many references to student engagement throughout, therefore, objective 3 (teacher's perception of student engagement) focuses more strictly on Schlechty's framework, as preferred by VLK Architects.

### **Need for Renovated/Replacement Schools**

When districts decide to renovate or replace schools, they face the question of how to go about such a task. They must consider the demographics, socioeconomic statuses, and academic achievement of their students. Texas is home to six of the fastest growing cities in the United States: Conroe, Frisco, McKinney, Georgetown, New Braunfels, and Cedar Park (U.S. Census, 2017). A growing population demands the need for more schools, and renovations of otherwise obsolete schools. These replacements, renovations, and new builds must reflect current educational standards and align with educational expectations and methods.

### **The Modern Classroom**

Although design dictates how students learn, there has been little challenge to architects over the past 20 years to adapt to new pedagogy (Brooks, 2011; Dittoe, 2002). Teachers are

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<sup>1</sup> Nathan S. Hutchens, a graduate assistant at the University of Arkansas, was hired by VLK Architects to conduct and write the literature review under the direction of the authors.

<sup>2</sup> Although VLK Architects commissioned the study resulting in this manuscript, the authors and firm are committed to the unbiased report of the findings of this research. In addition to the monetary compensation for second and third authors, the firm paid the travel expenses of all authors while conducting the study.

more likely to use whatever pedagogy suits them – regardless of design space (Dittoe, 2002). Therefore, there must be some agreement of some sort between school administration, the teachers, and the design team if the particular needs of the teachers are to be met (Dittoe, 2002). Student engagement is a very complex process that is fueled by the physical and psychological energy that the student devotes to the academic experience (Astin, 1999). If architects intend to impact student engagement through the purposeful design of learning spaces, the needs of the students and the pedagogical preferences of modern teachers must be deliberately considered throughout the design process.

### **Physical Space and Engagement**

Physical space can improve student learning beyond student's abilities as measured by standardized tests, and design of these spaces is thereby crucial (Brooks, 2011). Classrooms are believed to promote student-centered learning and to capitalize on student preferences and modern lifestyles (Gurzynski-Weiss, Long, Solon, 2015). Truly innovative spaces will enhance learning opportunities in a variety of ways by decreasing pre-task set up, facilitating student centered lessons, equalizing participation, and allowing students to work with more classmates than they would in traditional classrooms (Gurzynski-Weiss, Long, Solon, 2015). However, the reality is that unless teachers and instructors utilize a pedagogy that is functional with the intended use of the space, any design change on the basis of learning will be irrelevant (Bousslama & Kalota, 2013; Dittoe, 2002).

It may be useful to first identify the reasons for student disengagement as identified by Rudduck, Chaplain, and Wallace (Broadhead, 1996). They discovered that students were primarily disengaged for four reasons: homework is difficult because students were struggling with the class, students disliked lengthy writing assignments, students disliked subjects that were



not well understood, and they had increased anxiety about abilities as exams neared (Broadhead, 1996). It is notable that the classroom environment is not listed as one of these reasons; surely there are distractions that can disengage students, such as sound, classroom density, and class time in the day. Classrooms themselves are not responsible for the engagement of students; however, classrooms should be able to facilitate student engagement depending on the pedagogical approach of the instructor (Bouslama & Kalota, 2013; Dittoe, 2002; Brooks, 2011).

Classrooms must be related to learning and the persistence of learning in order to be effective spaces (Earthman & Lemaster, 2009). They must be able to facilitate the teaching and learning experience (Bouslama & Kalota, 2013). That is to say that a classroom is a physical reality and must be able to simply support the processes of teaching and learning (Dittoe, 2002). The physical nature of classrooms can be a positive influence on motivation and concentration as well (Miller, Erickson, & Yust, 2001).

Weinstein (1981) first discovered that large group, row type classroom arrangements facilitate teacher-centered lessons, whereas small group classroom arrangements are better for interaction among students. More simply, the classic rows of tablet chairs in classrooms have set the standard in a way that inhibits creative educators and hinders active learning (Dittoe, 2002). As previously alluded to, working with multiple partners in group work exposes learners to varied input, opportunities for interaction, and of course feedback (Gass, 1997). Herzog (2007) also identified several marked characteristics about classrooms:

- There is an increase in retention rate in students that took classes in rooms with windows.
- Large classroom size correlated to a decrease in academic success.
- Classes that are earlier in the day tend to correlate to greater academic success.

- As classroom density increases, academic success decreases.

### **Technology in the Classroom**

In modern education, large sums are invested in transforming classrooms into tech-equipped learning environments (Beery, Shell, Gillespie, & Werdman, 2013). Technology has seemingly overtaken modern schooling; SMART Boards, interactive projectors, integrated cameras and multimedia tools, and internet-based technologies have in and of themselves renovated the modern classroom (Bouslama & Kalota, 2013). Yet, just as classrooms facilitate the teaching and learning experience, technology has begun to facilitate the teaching and learning process (Bouslama & Kalota, 2013).

Modern classrooms often have a computer projection screen at the front as well as an instructor controlled computer (Gurzynski-Weiss, Long, Solon, 2015). An increase in the focus on presentation skills and public speaking have certainly contributed to the way that classrooms are now set up, but so have new technologies such as *Google Classroom* and tablet usage (Morquin, 2016; Diemer, Fernandez, &, Streepey 2013).

### **Effects of Technology in Education**

The majority of research done on technology in education has focused on higher education and the collegiate course load, whereas few studies are available regarding the effect of technology in primary education (Morquin, 2016). However, Morquin (2016), and Diemer, Fernandez, & Streepey (2013) discovered significant findings in their respective studies as illustrated on Table 1.



**Table 1**  
**Effects of Technology in Education**

Diemer, Fernandez, & Streepey (2013)	Morquin (2016)
Technology allows for students to engage in learning activities at higher cognitive levels.	Teachers perceive a sense of pride and completion within their students when they use these new technologies.
i-Pads and technology allow for students to engage in learning activities at higher cognitive levels.	Technology has provided teachers with the ability to appeal to different learning styles.
One-to-one computing can result in higher levels of student engagement.	Technologies such as Google Classroom have reduced the time needed to prepare for class.
Technology must be used in a way that is engaging; not use for repetitious drill.	Technology can allow for class work beyond classroom walls.

The most critical takeaway is that a teacher's perception of student engagement does not differ because of the use of technology; a teacher believes their methods are engaging regardless of technology (Diemer, Fernandez & Streepey, 2013; Bouslama & Kalota, 2013; Dittoe, 2002).

### **Schlechty Framework and Student Engagement**

Phillip C. Schlechty was ahead of his time; he recognized that electronic technologies are a major reason schools must change and technology can be used as a tool to bring forth that change (Ford, 2004). The change he referenced is the progression of schools from the current model that correlates teachers and material to a new model that focuses on the teacher and student relationship, and more directly the quality of assignments given to students (Bazenas, 2014; Schlechty, 2011). The current model places emphasis on memorization and regurgitation (ritualistic learning) rather than the value of information being taught (authentic learning) (Dietrich, 2012). Schlechty identified these five aspects of engagement that administrators must be aware of when encouraging the shift to a more student-focused curriculum (Conaway, 2003):

1. Authentic engagement, where the task, activity, or work the student is assigned or encouraged to undertake is associated with a result or outcome that has clear meaning and relatively immediate value to the student.

2. Ritual engagement, where the immediate end of the assigned work has little or no inherent meaning or direct value to the student, but is associated in the student's mind with extrinsic outcomes and results that are of value.
3. Passive compliance, where the student is willing to expend whatever effort is needed to avoid negative consequences, though he or she sees little meaning in the task assigned.
4. Retreatism, where the student is disengaged from the tasks, expends no energy in attempting to comply with the demands of the tasks, but does not act in ways that disrupt others and does not try to substitute other activities for the assigned tasks.
5. Rebellion, where the student summarily refuses to do the task assigned, acts in ways that disrupts others, and/or attempts to substitute tasks and activities to which he or she is committed in lieu of those assigned.

These elements of engagement are critical to Schlechty's "Working on the Work" framework. By creating an environment in which students are motivated to be authentically engaged, the information being taught is more likely to be retained (Schlechty, 2002). Schlechty's "Working on the Work" framework further identifies the methodology and necessary approach to create this authentic engagement.

### **"Working on the Work"**

The five patterns of student engagement are the emphases of the "Working on the Work" model of classroom design. Schlechty's framework hinges on the relationship between the student and teacher, rather than the teacher and content as he believes schooling has come to focus on (Schlechty, 2011). Therefore, the work that students do needs to be organized around students rather than around the teacher and schools, this work should also carry with it some

real-world application (Ford, 2004). The framework recognizes that the teacher can control two factors: the teacher's own relationship with the student, and the work the teacher assigns to the student. Schlechty identified 10 design qualities of instruction that help foster this relationship: content and substance, organization of knowledge, clear and compelling standards, protection from adverse consequences, product focus, affirmation of performance, affiliation, novelty and variety, choice, and authenticity (Schlechty, 2002). These 10 items are designed to help teachers better facilitate school work and design lesson plans to better benefit student development and foster student engagement.

The framework has been used qualitatively to create a lesson plan for sixth grade mathematics and was cited as being helpful in the creation of lesson plans (Ford, 2004). Conaway (2003) stated that students were not likely to be engaged in something they were not personally interested in. Therefore, the more relatable work is to every given student, the more likely that student is to be engaged (Schlechty, 2011). Engagement becomes more difficult with greater classroom diversity. Again, these studies provide qualitative explanations and do not delve in to standardized test scores which Schlechty states are the result of "how a school does its business" (Schlechty, 2011).

Schlechty's system is designed to change that focus from memorization to truly understanding material. However, the standardized test scores that are utilized to evaluate student engagement support the ritualistic engagement model (Bazenas, 2014). This contradiction has resulted in little quantitatively conclusive research supporting the framework (Tharp, 2015). Tharp (2015) also provided additional evidence refuting the Schlechty framework citing that it is expensive for districts to use without much tangible payoff, and that regardless of framework usage the pace of public school change is especially slow. It should

also be reiterated that engagement is a process that occurs within the classroom; however, the physical reality surrounding the process does not seem to have a direct impact on the degree to which students are engaged (Dittoe, 2002). Pedagogies and instructional methodologies should be agreed upon by administration before physical design, furniture, and other architectural aspects are considered (Dittoe, 2002).

### **Sound in the Learning Environment**

Sound in classrooms can be a huge inhibitor to the facilitation and learning processes in K-12 schooling. Classroom noise, inside or out, at deleterious levels can hinder speech perception but also reading scores, spelling ability, behavior, attention, and concentration in children (Smaldino, 2008). There are also large numbers of children that suffer from hearing loss and thereby require lower levels of background noise (Nelson, 2003). The goal for important signals is 15 decibels above ambient noise levels (Nelson, 2003). While there is not much well-controlled correlational research on the topic, there are several underlying principles of physics that govern the ideas present in the current literature (Hygge, 2003).

The transmission is reliant on the signal to noise ratio (SNR) which is the relative intensity of the teacher's speech compared with the level of any background noise in the classroom (Smaldino, 2008). The other measurable component is reverberation time (RT) which is the length of time a signal persists in a room after the original signal has ended (Smaldino, 2008). SNR and RT have a greater effect on children than typical adults (Nelson, 2003). This is because children have not yet developed the focus to separate background noise from more important signals (Samuels, 2007). Often, urban classrooms are bombarded with ambient noise, causing serious distraction for students (Samuels, 2007). Other traditional classrooms only facilitate the deliverance of speech energy to the front most rows and limit the spread of signals

throughout the classroom (Smaldino, 2008). However, there are several ways to adjust for these in modern classrooms, namely by introducing sound field amplification devices.

### **Sound Amplification Devices**

Sound amplification devices can include a wireless mic and several receivers or speakers placed throughout the classroom. These devices require less energy for voice projection; therefore, teachers are less fatigued (Smaldino, 2008). They also ensure that the teacher's voice reaches all students at a level louder than ambient noise (Wilson, Marinac, Pitty, Burrows, 2011). Teachers have also noticed the benefit in using sound-field or sound amplification systems (Dockrell & Shield, 2012). Teachers have noticed improved comprehension and performance in rooms with poor acoustics (Dockrell & Shield, 2012).

An interesting aspect of this synthesis of literature is the notion that the importance of academics is absent from the research as it relates to the built environment. While much has been researched about how to raise student achievement, no studies exist to show how the design of the school may have impacted student learning. It is our intent to add to the canon of literature how purposeful design can support and foster student engagement, leading to increased achievement.

### **Methods**

The findings reported in this manuscript, drawn from a larger study, focus on the impact school design has on student engagement. The impetus for this research was the desire of VLK Architects, the designers of the schools included in this study, to explore and identify the impact the design of replacement schools has on student engagement, achievement and the overall engagement of teachers. In order to answer the aforementioned research question, fourth and fifth grade student focus groups and teacher surveys were conducted at two elementary

replacement schools. Focus groups are an accepted research practice in empirical studies used to generate information about collective views (Gill, Stewart, Treasure, & Chadwick, 2008); the focus groups were designed to elicit the students' views and opinions (Creswell, 2014). Teacher surveys provided a quantitative description of the teachers' perceptions (Creswell, 2014).

Student focus groups were conducted using a protocol of questions, recorded, and narratively analyzed for common themes. The anonymous teacher surveys were distributed via email and analyzed using Qualtrics. All participants attended and taught in both the original school building, and the newly designed campus.

The study was conducted at two Houston area schools, Margaret S. McWhirter Elementary School in Clear Creek ISD and Condit Elementary School in Houston ISD. After being granted permission through both school districts research protocol process, the campus administrators identified the fourth and fifth grade male and female students for the focus groups. The students' ages ranged from 10-11 years old and those participating attended school in the previous and replacement campuses. Parent permission was obtained for each participant utilizing a parent recruitment letter and prior to interviews commencing; the students were asked to verbalize that they were willing to be involved in the group. Semi-structured student focus group interviews were conducted; an average of five students participated in each group. The questions, found on Table 2, focused on the students' experiences in the previous and replacement facilities with the intent to shed light onto the impact a replacement building has on student engagement.

The student focus groups were recorded, transcribed and analyzed using V-Note, software designed for coding of audio recorded data. Once all the transcripts were reviewed, the data was coded and themes were identified within the student responses. The common threads

from the gathered responses were then discerned in order to build literature regarding replacement schools and the impact new buildings have on teachers' and students' engagement.

**Table 2**  
**Student Focus Group Questions**

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1. What has it been like for you to be a student at this school since the new building was built?
  2. What differences have you noticed since you all moved from the old building to this building?
  3. Do you believe going to school in this new building changed the way you learn? If so, how?
  4. What do you think was the most difficult thing about learning while going to school in the old building? How has the new building helped with that?
  5. Do you agree or disagree with this sentence: My old school is a good place for me to learn? Why or why not?
  6. Do you agree or disagree with this sentence: My school is a good place for me to learn? Why or why not?
  7. How has the new school changed how much attention and how hard you work when learning?
  8. How has the new school changed how much enthusiasm you put into learning?
  9. How has the new school changed the time you spend working on what the teacher asked you to do?
  10. Do you feel like it is easier to agree with your teacher to do work in the new school?
- 

In order to further explore the impact replacement schools have on student engagement, teacher surveys were conducted at each elementary school (McWhirter and Condit); refer to Table 3 for the survey questions relevant to this manuscript. Teachers completed the survey in an average of 7 minutes. They rated their agreement with each statement on a 4-point scale ranging from “strongly agree” to “strongly disagree.” The questions aimed to explore the teachers' perceptions about student engagement.

The teacher survey was distributed to all teachers at two schools and those participating were asked to complete an online consent form prior to accessing the survey. Teachers who agreed to be part of the study completed the survey. Teachers were able to complete the survey online at their convenience within a 2-week period. Given that teacher participation was



voluntary, the goal was to have at least 50% participation and secure a sample size of at least 30 teachers. Out of 95 teachers, 73 completed the survey; only the 64 teachers, 67.3%, that reported they had worked in the old building as well as in the new replacement campus were included in the data analysis.

**Table 3**  
**Teachers' Perceptions of Student Engagement and Learning**

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Since we moved to the new building,

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- our students are more engaged in learning.
  - our students' academic achievement has improved.
  - our students spend more time working collaboratively.
  - the students' attendance has improved.
  - our students are prouder to be part of our school.
  - severe discipline problems have decreased.
- 

In order to produce trustworthy research, the study was designed to establish reliability and validity of the findings. For the student focus groups, triangulation was achieved in a variety of ways. First, three researchers conducted the interviews in order to review and agree that themes surfaced in the interviews. Additionally, multiple sources (students and teachers) were included in the study in order to establish various points of view; common themes presented by the participants comprise the conclusions of this study. Reflexivity was accomplished, as the biases of the researchers were identified, and the research team worked to keep them minimized. Rather than contradicting a participant, the team probed to understand more about a point of view when disagreement could have surfaced. Finally, negative case sampling techniques were used to determine additional perspectives that were not anticipated. Outlying responses that were infrequently gathered were studied to determine if they should be considered as an alternate point of view. The study resulted in conclusions that naturally presented themselves via

grounded inferencing, rather than establishing a protocol of questions that led the participants in one direction.

## **Findings**

### **Students' Perceptions**

Upon coding the students' focus group data, three salient themes emerged. Students' perceptions of (1) the new spaces and the impact those have on their overall school experience, (2) the impact going to a new school has had on their engagement in learning, and (3) the changes in their teachers since moving to the replacement school. During coding, additional common themes emerged. Although not as frequently, the other themes were mentioned by multiple students during the focus groups. The secondary themes include sound, light and windows, safety, and technology.

**Room to learn and explore.** During the focus groups at both sites, students referred to the new spaces they have to learn, work collaboratively or independently, as well as the novel spaces they have in the new school that were non-existent nor possible in the old building. Students reported that going to school in a replacement building makes them want to go to school. A fifth-grade boy stated that "The old school was all dark and gloomy, and I didn't want to go to school. Now, I feel like I want to go to school. I love being in the new building." Other students indicated that the new building gives them a feeling of freedom and comfort. A student said that in the old building, "In the classrooms, it felt like we were trapped. In this school, it's more open. We can see the light, the sun because of the windows." Other students expressed their dissatisfaction with the layout of the old building, where they had to go outside when going from their classroom to other parts of the school. Similarly, at the other site, students repeatedly

discussed how inconvenient the layout was; younger students had to walk around the school to go to the nurse. They noted that the new design of both schools addressed all these issues.

Students consistently referenced the spaciousness of their classrooms but also reported appreciation for the new spaces outside the classroom including an open-concept library, the “Makerspace”, collaboration spaces in the halls outside their classrooms, the new art classrooms, and the gym. For instance, the students talked about their new library. A student stated that “The library instead of being enclosed, it’s part of the school. It’s open, it’s so nice. You can roam around more. In the old school, it was a box.” Another student said, “There are arches where we can sit in. In the old school, we had assigned seats in the library. It makes me want to go to the library. We have different chairs and more computers. In the old building, we had to wait in line for the computers.” While yet another student indicated that “If you forget your books, you can go to Makerspace, read magazine. In the old library, you could only check out books.” When asked to elaborate about the Makerspace, which was mentioned by students in every focus group at that school, a student explained “We have this new thing; it’s called Makerspace. We have all these activities that can help you with your brain. There are blocks, when you’re building the blocks, it makes you focus because you have a goal.”

At one of the schools, students talked about the collaboration spaces outside their classrooms. One student explained, “Whenever we try to get the entire grade level together, we sit outside our classrooms where there is a projector and a white wall. We use the projector to project and we sit there to collaborate.” While another student said that teachers use those spaces outside the classrooms to pull small groups to work since it’s quieter than the classroom.

While students consistently reported an excitement about going to school in a replacement building, a number of students reported missing the memories and sense of family that their previous building provided. A fifth-grade girl said:

At the old school, I feel like we knew and saw each other more. Now we're all separated.

The old school felt like a family; new school is more wide open. We used to see first and second graders all the time. We were like a huge family; now we are separated into different rooms; I barely see them anymore. It was smaller; now that it's bigger, we aren't as much as a family but it's still good but I miss the family.

**Engagement in learning.** During a discussion about learning engagement, and the efforts students put into learning since the move, a high regard was reported repeatedly for the teachers while in the old and new buildings. However, the students noticed the impact going to school in a new building has had on their pride to be students at these schools, their engagement and commitment to learning, and the effort they put into learning to make their teachers proud. A student said "The new building has changed me because I need to work harder. I have more space; I can lay out, put all my stuff on the floor. It helps me." Another student indicated that "Days seemed much longer in the old school. Now we are having fun. It goes by quicker. It makes me feel like school is not school, it's fun. We are still learning but it's fun to learn now." A student explained, "We can go different places to work with partners or work quietly. We can also go to the round tables and computers outside the classrooms. Sometimes the teacher allows us to go work out there with a partner and work on assignments." Students also indicated being more focused and interested in finishing their work in order to have opportunities to engage in activities that are possible as a result of the unique spaces in the new buildings. A fifth-grade girl supported what her schoolmates what previously said by explaining that,

At the old school, we were in small spaces. We didn't really have much space to be working in maybe groups, to learn to synergize and work better together. So, this year, we are touching on that more so we can work in groups even if we don't necessarily like the people, and learn how work with new people because now we have lots of space to work together.

Students also expressed their satisfaction with the white walls where they can write anywhere without having to worry about easels or white boards. They found that having the writeable walls saved time and allowed for more engaging lessons. Two students said, "it's easier to use that the smaller white walls." "Everyone can check their work at once because we can write it all over the walls. It saves a lot of time."

While indoor learning spaces were repeatedly mentioned, students also highlighted their appreciation for the outdoor learning spaces. A student shared:

In science, we have a balcony that comes off the science lab that we can go on and we can do our work outside. We can be in the outdoor environment but still connected to our science classroom. It helps you focus.

Given the new science facilities, students repeatedly brought up the different experiences they are having. A student explained that "In science, we do a lot more hands-on things, experiments, that way we can remember by actually doing it." While another one stated, "Last year, we just had a regular classroom. Now, the science teacher has a science classroom, with sinks. We feel like scientists." A different student expressed the students' willingness to learn since moving to the new building;

When we were in the old school, people didn't want to do anything educational. Most people wouldn't want to do that in school. But now in the school, when we did make our

movies, we tried to put an educational, service or community statement on it because we wanted to.

Furthermore, students shared their perceptions of the impact the new building has on their teachers' efforts and willingness to plan project-based learning opportunities for the students. A boy said, "We definitely have more projects because in the old building, they just didn't have time. It was such a hassle for everybody; nothing really worked."

**Happier teachers.** Teachers participated in this study in an effort to explore their perceptions of student engagement. However, an unexpected theme emerged, the students' perceptions of their teachers' excitement about being at school. A boy said that:

Teachers look happier. In the old school, they looked more frustrated. The rooms were very enclosed or things were wrong with their computers or the Smart Board. In the old school the technology kept messing up; in the new school, it doesn't mess up as much.

Two other students stated that "I see a difference in the way they use the classrooms." "I feel they (teachers) are happy that they have more space, more cabinets." While another student explained that teachers "are calmer. They don't have to rush everywhere; they are not bumping into everything. They are fluently moving around, teaching fluently. It is easier to hear and understand them." While other students said, "teachers are happier; it's more convenient." "With all the space in the classrooms, teachers have more space to organize, put shelves everywhere to store notebooks, put tablets away. We don't have to constantly go across the hall to get a charger, we can just charge them in the cabinets."

Students repeatedly expressed their awareness of how happy the art, music and physical education teachers are in the new building where they have their own rooms. A fourth-grade girl explained:

Our art teacher is happy. In the old building, she didn't have a room. She had to take an art cart everywhere, to each classroom. Now she has these tables with compartments in them and she has a kiln. I felt so bad for her. Now she has an art room; I'm so happy for her.

At one of the schools, students consistently spoke highly of their physical education teacher. A female fifth-grade student shared, "He has been here since we were in kindergarten. Everyone has always loved PE because he makes it super fun." Time after time, after sharing their love for their PE teacher, students expressed their joy when seeing their PE teacher in the new space. A boy described how difficult it was for the physical education teacher when they did not have a gym. "Sometimes, we had to sit in a room and play cups, stack cups. That was your PE because it was so hard for him to find a place to work. Now, he has the MPR and he has his own office."

### **Safety, Light, Sound and Technology**

During the student focus group data coding, four secondary themes were identified. While not as extensively discussed by the students, the topics emerged during the conversations with all focus groups. Safety was the exception; safety was consistently discussed in all the focus groups at one of the schools but not mentioned at all in the other school.

**Safety.** One of the schools included in this study is a Title I school, where 71% of the students qualify for free or reduced lunch. At that school, students consistently brought up and explained how safe they feel in the new building. Students mentioned that the ceiling is sturdier, there are less bugs in the building, the new building has a more pleasant smell, and there are more fire exits.



**Light.** At both schools, students brought up windows and natural light. Students pointed out that they did not have many windows in the old buildings. Two students explained, “In the old school, there were barely any windows”; “There are lot more windows in the new school.” While others shared “The old school was all dark and gloomy and you didn’t want to go to school. Now, I feel like I want to go to school. I love being in the new building.” “It makes me feel happy, relaxed to have all these windows.” After their classmates talked about the windows, a student stated,

When you’re sitting in your seat, you just don’t stare at a wall, there is a window to look out. I really like the windows. There is a smaller one, like a little rectangle. Our teacher like keeps it open and I really like that. I like keeping the blinds up and being able to see outside. I love being outside; it helps me concentrate hearing the wind blowing. I like having the windows.

**Sound.** At both schools, students shared frustration caused by unnecessary sounds from areas outside the classroom and the impact noise has on their ability to concentrate and engage in learning. For example, one of the students explained that in the old building, it was difficult to learn with all the noise from the music classroom. While another student said,

In the old school, it was hard to focus because there was a lot of noise from outside. Now because we are at a higher level in the building, there is less noise. It’s more quiet. It’s easier to learn in the new building.

Yet another student shared that “We could hear through the walls; we were so close to other classrooms. Now we can still hear others but it’s much quieter now.”

**Technology.** Students consistently discussed the access and use of new technology. It was evident that in the old building, the outdated infrastructure impeded the use of technology.

A fifth-grade girl explained, “We are exposed to a lot more technology now”; “The technology is faster.” While other students explained that “Now, we have Chromebooks so they don’t have to write everything. We can type things up and send the work to the teacher.” Furthermore, a number of students expressed the impact having access to technology has impacted their desire to write. One student stated that “Sometimes, you don’t want to write but we are using computers so that actually makes you want to write.”

### **Teachers’ Perceptions of Student Engagement**

Teachers that worked at both the old and replacement buildings were asked to voluntarily complete an anonymous online survey about their perceptions about students’ engagement in learning since moving to the replacement building. Sixty-four teachers indicated that they had worked in both buildings, and 49 teachers, 76.5%, completed the survey. Teachers were asked to rate their agreement with six statements on a four-point scale, 1 representing “strongly disagree” and 4 being “strongly agree”; three of the statements were focused on student engagement since moving to the new building.

Teachers were asked to express their agreement with multiple statements focused on student engagement. Table 4 illustrates the results of the surveys including the percentage of students that agreed or strongly agreed with each statement, mean score on a 4-point scale, standard deviation and variance.

**Table 4**  
**Teachers' Perceptions of Student Engagement**

<b>Statement</b>	<b>Percentage</b>	<b>Mean Score</b>	<b>Standard Deviation</b>	<b>Variance</b>
“Since moving to the new building, our students are more engaged in learning”	75.5	2.98	0.68	0.47
“Since moving to the new building, our students spend more time working collaboratively”	89.7	3.20	0.61	0.37
“Since moving to the new building, our students are prouder to be part of our school”	93.8	3.31	0.58	0.33

### **Discussion**

The current mixed-methods study addresses the question as to the impact of a newly designed elementary school on student engagement. Both students and teachers contributed to the study, as their perceptions are valued in order to determine possible implications. By studying the voice of students, both architects and educators can gain understanding as to the impact of school design. Three consistent themes emerged from the focus groups with students: (1) the new spaces and the impact those have on their overall school experience, (2) the impact going to a new school has had on their engagement in learning, and (3) the changes in their teachers since moving to the replacement school. These themes will be discussed as they relate to architectural design.

## **Purposefully Designed Learning Space**

Every space, regardless of the size, is designed with purpose. What is to occur here? How many students will need to use it at one time? What other academic programs or activities might take place in this space? Is it the right size to accomplish all of these attributes?

Students spoke about the ample space to learn throughout each of the interviews. This aligns with the need for architects to review current programming needs in order to design learning areas that reflect the square footage that allows for students to have their own area(s) for learning. Space to learn is critical, as students experiencing the rigor of current academic standards are required to comply with an inquiry-based approach where teachers have designed lessons that mandate active learning.

“In the [old] classrooms, it felt like we were trapped,” indicates the absence of choice countered by, “In this school, it's more open,” suggests a feeling of freedom. Designing for the inclusion of open space with natural light makes students feel more comfortable at school. By harvesting daylight, including clerestory, and orienting schools in order to maximize and use sunlight, students benefit both academically and emotionally.

Focus groups revealed the need for space to foster collaboration. “Whenever we try to get the entire grade level together, we sit outside our classrooms... to collaborate,” suggests that grade level learning is accomplished due to purposeful design. These areas are provided with floor to ceiling writeable surfaces as well as projectors so that various forms of instruction can take place based on curricular needs. The established adjacencies of these areas have an open feel allowing one area to naturally flow into the next for teacher and student use as the school composition moves from flexible space to classroom.

Specialized areas such as the library, art room, gym, and Makerspaces should reflect intended student experiences. It is the intent of designers to have every learning area “help you with your brain.” Students frequently mentioned how they enjoy using these spaces. Incorporating innovative space that can be used with current instructional materials keeps the interest of students and assists teachers with modern methodologies.

### **Spaces Designed to Foster Student Engagement**

The learning process is dependent on student engagement (Schlechty, 2002). Because authentic engagement is more likely to yield mastery learning, the student experiences that were detailed for us by the participants would suggest that increased engagement is occurring in these replacement schools. Additionally, if authentic engagement produces deeper levels of learning, increased student achievement is also suggested.

“We are still learning but it's fun to learn now,” reveals the commitment to personal education, but a new excitement that allows for sustained attention and enjoyment that was not present in the original school. Purposefully designed collaboration areas are viewed by students as learning spaces that allow them “to synergize and work better together.” Space both within the classroom, and outside the classroom, as well as multiple, open, flexible spaces in these schools promote various learning areas where students not only feel more comfortable, but are also more excited about learning.

“The new building has changed me because I need to work harder” sounds like the sentiment of a focused and authentically engaged student. This student also is aware of his learning needs when he shares, “I have more space; I can lay out, put all my stuff on the floor. It helps me.” Having space in order to organize yourself is crucial to the learning process,

especially when an inquiry-based approach is used. How space works together with furniture either fosters learning, or restricts it.

**Areas for collaboration.** Students reported higher levels of engagement because they had additional areas in which to learn. One student expressed, “We can go different places to work with partners or work quietly. We can also go to the round tables and computers outside the classrooms. Sometimes the teacher allows us to go work out there with a partner and work on assignments.” The areas designed to extend the classroom environment and offer areas for small groups to remove themselves in order to focus on a specific learning experience are appreciated by students. Student reported enjoying the ability to work with another student, or with a group, which supports the type of cooperation that the work force indicates is needed in future jobs. Areas that foster collaborative problem solving, with access to technology, are necessary for the modern learning environment.

**Personal space.** Students need to feel personally comfortable in the space they are provided, and should not be limited by a mere desk in order to learn. Space is important as new instructional techniques are utilized, as described by one student:

At the old school, we were in small spaces. We didn’t really have much space to be working in maybe groups, to learn to synergize and work better together. So, this year, we are touching on that more so we can work in groups even if we don’t necessarily like the people, and learn how work with new people because now we have lots of space to work together.

Having ample space to allow for movement, intentionally-sized student groups, and materials increases the probability that students will engage in the work. This student seems to be much more comfortable doing the work in the right space, even if she would have preferred to work

with someone else. This is interesting to consider, as this type of learning experience prepares students for future problem solving skills as adults in the workforce.

**Instructional materials.** Incorporating updated materials into the classroom seemed to not only be appreciated by students, but also viewed as a means of efficiency. Specifically, the use of white walls as a designated learning area inside the classroom were more than novel. One student indicated, “It’s easier to use that the smaller white walls.” Importantly, another indicated, “Everyone can check their work at once because we can write it all over the walls. It saves a lot of time.” Classroom design contributes to teaching and learning efficiency. No one is more aware of the use of time during a lesson than students. They want to be actively involved, not waiting. Increasing the number of students involved in the lesson curbs off-task behavior and increases opportunities for authentic engagement.

**Science labs.** Students discussed specifically, without prompting, newly designed science learning areas. Students revealed that they were experiencing much more “hands-on things, experiments...” which aligns with curricular expectations and rigorous standards for experiential learning. “We can remember by actually doing it,” again suggests authentic engagement and increased levels of learning, thus, student achievement. “We feel like scientists,” aligns with the belief that architecture should reflect the curricular needs of teaching and learning. It also supports the desire to design spaces that emulate industry, especially in the science, technology, engineering and math (STEM) content areas based on the identified future career needs to support our future society (Vilorio, 2014). In these schools, science labs offered natural light, flexible furniture, exposed color-coded building systems, and ample sinks for group work.



## **Design to Support Teaching and Learning**

The design process is methodical. It should reflect the needs of the end users -- teachers and students. The outcome of a great design produces satisfied clients. “Teachers look happier. In the old school, they looked more frustrated,” suggests the importance of the relationship between teacher and student, as well as satisfaction. Mutual respect usually exists between teachers and students. This was evident in the discourse. Students in this study saw an obvious difference in the way teachers responded to the lack of, or inconsistency of technology prior to moving into the new school. Having updated technology to support modern teaching methods is crucial.

Storage is always important to teachers. Increased storage was provided in these two schools, and students were keenly aware of it, “...they have more space, more cabinets.” Because of this, it was indicated that teachers “are calmer.” Important for teaching and learning, students observed that teachers are “fluently moving around, teaching fluently. It is easier to hear and understand them.”

Again, teacher satisfaction is suggested by students, “Teachers are happier; it’s more convenient.” For teacher recruitment and retention purposes, many times both the composition and the condition of the school is critical. “With all the space in the classrooms, teachers have more space to organize” indicates the ability of the teacher to accomplish intentional lesson outcomes by having ample storage which allows for material organization.

## **Other Important Design Considerations**

Although not considered prevalent, four additional themes emerged from our student conversations. Each has an impact on design: safety, light, sound and technology. First, participants shared how they felt safe in the new school. A secure entrance vestibule was

integrated into the design of each campus. Second, the use of light in the classrooms was appreciated, “It makes me feel happy, relaxed to have all these windows.” Rather than feeling like they were still in a “dark and gloomy” school, students now take a mental learning break where “you just don’t stare at a wall, there is a window to look out.” Natural light was introduced to classrooms as well as many shared spaces in order to align with best practices.

Next, acoustically treated spaces were designed throughout both buildings in order to improve sound quality. Students shared that it was noisy prior to moving into the new school, as much noise was overheard from areas such as outdoors and the music room. Now, even when they hear noise from an adjacent area, “...it’s much quieter.” The purposeful reduction of unnecessary sounds can positively impact student engagement in learning. Noise, from inside or outside the classroom, can hinder students’ academic performance, attention and engagement in learning (Smaldino, 2008).

Finally, technology now works in both buildings, which is crucial to the students’ preferences. Technology upgrades now “work” and “are faster” after both a new infrastructure was created and new devices were purchased. The purposeful placement of wireless access and the coordination of desired devices have improved the digital learning environment, which has caused students to work more efficiently and have an increased desire “to write.”

### **Teachers’ Perceptions**

Teachers’ perceptions were also collected via electronic survey. Specific statements were evaluated based on their experience and observation of student learning in the newly designed spaces after a year in the new buildings. Teachers were required to focus on student behaviors with regard to perceived engagement as they shared their professional opinions. Significantly, teachers reported that since moving into the new building, (1) students were more engaged in

learning, (2) students spent more time working collaboratively, and (3) are prouder to be part of the school. These three opinions have a profound influence on how well students may learn in these innovatively designed learning environments for quite some time.

### **Conclusions**

Purposeful design, aligned with a school organization's instructional intentions has the power to create feelings of pride, make students want to engage at higher levels, and suggests the improvement of student achievement over time due to the connection between authentic engagement and profound learning. Happier places are created for both students and teachers, which has implications for teacher recruitment and retention, as well as stakeholder satisfaction and the potential for enrollment growth. The implications of these findings for school design support the need to create facilities that invite collaboration and engagement. Spending anywhere from seven to eight hours per day in a building that is open, inviting, noise efficient, and secure lends itself to a better learning experience. The intentional design of these campuses has impacted student opinion regarding their daily involvement with each other, their teachers, and more importantly their pursuit of knowledge.

Further research is needed as an extension of this study. The impact of school design on teacher collaboration and professional learning should be explored. The study of teacher collaboration and professional learning would allow researchers and practitioners to understand the impact facilities have on teachers' collaboration, their professional learning and the use of available spaces. It is important to understand how the use of the internal and/or external spaces in a campus increases the depth or engagement in teacher professional development. Another field of importance is student achievement and the correlation between learning spaces and

academic performance. The implications of the results of a correlational study focused on student achievement and learning spaces could significantly impact the school design field.

School design has the potential to impact multiple areas of learning and development for educators and students. Those professionals who design facilities are becoming more cognizant and responsive to the details of design and how a building can allow for higher levels of student engagement. The future of school design, the internal and external spaces, and how those who utilize them succeed should be an important topic for both architects and educators to continue to explore.

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